

IN THE CLAIMS

Amend claims 1, 6, 9, 13, 16, 19 and 20 as follows:

1. (Currently Amended) A polishing method for a copper film by chemical mechanical polishing, comprising forming a protection-layer on the copper film with a forming agent, polishing the protection-layer away on a convex portion of the copper film, oxidizing a surface of the convex portion of the copper film by an oxidizing substance and rendering an oxidized substance water soluble as a copper ion by phosphoric acid, wherein a polishing liquid used in said polishing is substantially free from abrasive, and contains an oxidizing substance, a phosphoric acid and a protection-layer forming agent comprised of an anticorrosive and a surfactant of a molecular weight not less than 10,000 to increase a rate of the polishing.

2. (Original) A polishing method according to claim 1, wherein said oxidizing substance contains hydrogen peroxide, and said phosphoric acid contains one selected from the group of orthophosphoric acid and phosphorous acid.

3. (Original) A polishing method according to claim 2, wherein said protection-layer forming agent contains benzotriazole.

4. (Original) A polishing method according to claim 2, wherein said protection-layer forming agent contains a carboxyl-containing polymer.

5. (Original) A polishing method according to claim 2, wherein said protection-layer forming agent contains one selected from the group of polyacrylic acid, polyammonium acrylate, polyamine acrylate, and a bridged polymer thereof.

6. (Currently Amended) A polishing method for removing a copper film over an insulating film by chemical mechanical polishing, comprising forming a protection-layer with benzotriazole and a polymer, polishing the protection-layer away on a convex portion of the copper film, oxidizing a surface of the convex portion of the copper film by an oxidizing substance and rendering an oxidized copper film water soluble by a phosphoric acid,

wherein a polishing liquid used in said polishing contains an oxidizing substance, a phosphoric acid, a

benzotriazole and polymer of a molecular weight not less than 10,000 and is substantially free from abrasive to increase a rate of the polishing.

7. (Previously Presented) A polishing method according to claim 6, wherein said oxidizing substance contains hydrogen peroxide, said phosphoric acid contains one selected from the group of orthophosphoric acid and phosphorous acid, and a thickener of a molecular weight not less than 10,000 contains one selected from the group of polyacrylic acid, polyammonium acrylate, polyamine acrylate, and a bridged polymer thereof.

8. (Previously Presented) A polishing method according to claim 7, wherein metal film comprising a first metal film of a barrier metal and a second copper film is formed over said first metal film.

9. (Currently Amended) A polishing method comprising the steps of:

(a) depositing a first metal film of a barrier metal on an insulating film having convex and concave portions, depositing a second metal film of copper on the first metal film;

(b) removing the second metal film on the convex portion and leaving the second metal film in the concave portion on the first metal by chemical mechanical polishing comprising forming a protection-layer with a forming agent on a surface of the second metal film, polishing the protection-layer away on a convex portion of the surface, oxidizing a surface of a convex portion of the second metal film by an oxidizing substance and rendering the oxidized metal water soluble by a phosphoric acid, wherein a polishing liquid used in said polishing contains an oxidizing substance, a phosphoric acid and a protection-layer forming agent and is substantially free from abrasive;

(c) removing the first metal film on the convex portion and leaving the first metal in the concave portion by chemical mechanical polishing by a polishing liquid containing an oxidizing substance, a phosphoric acid, a protection-layer forming agent comprised of an anticorrosive, and a surfactant of a molecular weight not less than 10,000 and an abrasive to increase a rate of the polishing.

10. (Previously Presented) A polishing method according to claim 9, wherein said oxidizing substance contains hydrogen peroxide, said phosphoric acid contains one selected from the

group of orthophosphoric acid and phosphorous acid, and said protection-layer forming agent contains benzotriazole and surfactant.

11. (Original) A polishing method according to claim 9, wherein said oxidizing substance contains hydrogen peroxide, said phosphoric acid contains one selected from the group of orthophosphoric acid and phosphorous acid, and said protection-layer forming agent contains a carboxyl-containing polymer.

12. (Original) A polishing method according to claim 9, wherein said oxidizing substance contains hydrogen peroxide, said phosphoric acid contains one selected from the group of orthophosphoric acid and phosphorous acid, and said protection-layer forming agent contains one selected from the group of polyacrylic acid, polyammonium acrylate polyamine acrylate, and a bridged polymer thereof.

13. (Currently Amended) A method for manufacturing a semiconductor device, which comprises forming, over a semiconductor region, an insulating film having an opening, depositing a first metal film made of a barrier metal and a

second metal film of copper over said insulating film and inside of said opening, thereby filling said opening with said deposited metal films, removing said second metal film over said insulating film by chemical mechanical polishing with a first polishing liquid containing an oxidizing substance, a phosphoric acid and a protection-layer forming agent of a molecular weight not less than 10,000 to increase a rate of the polishing but being free of an abrasive, thereby exposing the surface of said first metal film and said second metal film inside of said opening, and removing said first metal film exposed over said insulating film by chemical mechanical polishing with a second polishing liquid containing an abrasive,

wherein the removing of said second metal film comprises forming a protection-layer with a forming agent, polishing the protection-layer away on a convex portion of the second metal film, oxidizing a surface of the convex portion of the second metal film by an oxidizing substance and rendering an oxidized second metal film water soluble by a phosphoric acid.

14. (Previously Presented) A method for manufacturing a semiconductor device according to claim 13, wherein said

second polishing liquid is comprised of an oxidized substance, a phosphoric acid, a protection-layer forming agent of a molecular weight not less than 10,000 and the abrasive.

15. (Original) A method for manufacturing a semiconductor device according to claim 13, wherein said second polishing liquid contains the protection-layer forming agent in a larger amount than said first polishing liquid.

16. (Currently Amended) A method for manufacturing a semiconductor device, which comprises forming, over a semiconductor region, an insulating film having an opening, depositing a first metal film made of a barrier metal and a second metal film made of one selected from the group of Cu, an alloy composed mainly of Cu and a Cu compound over said insulating film and inside of said opening, thereby filling said opening with said deposited metal films, removing said second metal film from the surface of said first metal film over said insulating film by chemical mechanical polishing with a first polishing liquid containing hydrogen peroxide, a phosphoric acid, benzotriazole, and one selected from the group of polyacrylic acid, salt thereof to increase a rate of the polishing, and a bridged polymer thereof but being free of

an abrasive thereby exposing the surface of said first metal film over said insulating film and said second metal film inside of said opening and removing said first metal film exposed over said insulating film by chemical mechanical polishing with a second polishing liquid containing an abrasive,

wherein the removing of said second metal film comprises forming a protection layer of a molecular weight not less than 10,000 with a forming agent comprised of benzotriole and one selected from the group of polycrylic acid, salt thereof to increase a rate of the polishing and a bridged polymer thereof, polishing the protection-layer away on a convex portion of the second metal film, oxidizing a surface of the convex portion of the second metal film by an oxidizing substance and rendering an oxidized second metal film water soluble as a copper ion.

17. (Previously Amended) A method for manufacturing a semiconductor device according to claim 16, wherein said second polishing liquid is composed of an oxidizing substance, a phosphoric acid, a protection-layer forming agent comprised of said benotriazole, and one selected from the group of

polyacrylic acid, salt thereof, and a bridged polymer thereof and the abrasive.

18. (Original) A method for manufacturing a semiconductor device according to claim 16, wherein said second polishing liquid contains benzotriazole, and one selected from the group of polyacrylate, salt thereof and bridged polymer thereof in an amount larger than said first polishing liquid.

19. (Currently Amended) A metallization method comprising removing a first metal film which is formed over an insulating film and is made of a barrier metal and a second metal film which is formed over the surface of said first metal film and is made of one from the group of Cu, an alloy composed mainly of Cu and a Cu compound, wherein said second metal film is polished with an abrasive-free polishing liquid which contains an oxidizing substance, a phosphoric acid and a protection-layer forming agent, followed by a polishing of said first metal film by dry etching,

wherein the polishing of said second metal film comprises forming a protection-layer with a forming agent comprised of an anticorrosive and a surfactant of a molecular

weight not less than 10,000 to increase a rate of the polishing, polishing the protection-layer away on a convex portion of the second metal film oxidizing a surface of the convex portion of the second metal film by an oxidizing substance and rendering an oxidized second metal film water soluble by phosphoric acid.

20. (Currently Amended) A method for manufacturing a semiconductor device, which comprises forming, over a first interconnect layer disposed over a semiconductor region, an insulating layer having a groove extending to said first interconnect layer, depositing and stacking a first metal film made of a barrier metal and a second metal film made of one selected from the group of Cu, an alloy composed mainly of Cu and a Cu compound over said insulating film and inside of said groove, thereby filling said groove with said stacked metal films, removing said second metal film and said first metal film from the surface of said insulating film by chemical mechanical polishing with a polishing liquid containing an oxidizing substance a phosphoric acid and a protection-layer forming agent, thereby exposing said second metal film embedded in said groove, treating the exposed surface of said second metal film in said groove with plasma of a sub-

atmospheric pressure, and allowing a second interconnect layer to adhere onto said second metal film exposed in said groove and to lay over the surface of said insulating film,

wherein the polishing of said second metal film ~~comprised~~ comprises forming a protection-layer with a forming agent comprised of an anticorrosive and a surfactant of a molecular weight not less than 10,000 to increase a rate of the polishing, polishing the protection-layer away on a convex portion of the second metal film, oxidizing a surface of the convex portion of the second metal film by an oxidizing substance and rendering an oxidized second metal film water soluble by a phosphoric acid.

21. (Original) A method for manufacturing a semiconductor device according to claim 20, wherein said oxidizing substance contains hydrogen peroxide, said phosphoric acid contains one selected from the group of orthophosphoric acid and phosphorous acid, and said protection-layer forming agent contains one selected from the group of benzotriazole and a carboxyl-containing polymer.

Claims 22-23. (Cancelled)